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(54) Wood preservative

(57) The present invention deals with preservatives for wood and other organic fiber products. It is based on water-soluble copper and zinc salts of weak acids. After a solution of the

salts has been introduced into the wood the salts are converted so that relatively in-soluble preserving metal radicals are precipitated in the wood. The protecting effect of the preservatives and the precipitation of the metal radicals can be increased by suitable additives.

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SPECIFICATION
Wood preservative

The present invention relates to preservatives for wood and other organic materials, such as paper products, textiles and leather.

5 The preservative is based on the use of compounds of the metals copper and/or zinc. The preservative is intended to give permanent protection. Therefore it is of importance that the protecting agents are resistant and not converted by influences from outside such as for instance air, moisture and sun. In this respect the metals are unsurpassed in contrast to organic compounds which can initially have a high protecting effect but they are gradually influenced and converted to inactive compounds.

10 There exists a long experience of preservatives where copper and zinc have been the sole 10 protecting ingredients.

Copper sulphate has been used for pole preservation. As copper sulphate rapidly attacks iron it has not been possible to use pressure treatment in iron cylinders. Instead a simpler treating method has been used — sap displacement — for the introduction of the preservative into the wood. In spite of the 15 fact that the salt is soluble, that a simple method for its introduction into the wood is used, and that the wood by its contact with the soil is exposed to severe attacks, good protection has been obtained. This 15 can easily be exemplified. The explanation must be considered to be connected with the high protecting effect of the copper and with the fact that the soluble copper salt is not completely leached out but to a certain extent is firmly fixed in the wood.

20 Further, zinc chloride has been used to a large extent. In spite of its corrosiveness it has been possible to use rational pressure treatment in iron cylinders. The salt has given a good and all round protection but for today's duties it cannot be considered to give satisfactory protection for wood which is exposed to heavier attacks. Where only weaker attacks prevail it has provided permanent protection. Zinc gives a less effective but perhaps a more all round protection than copper. Also zinc chloride is 25 fixed to some extent in wood but not to the same extent as copper. 25

The present invention includes the use of copper and zinc in a more effective way than before. This is made possible by combining the metals with a weak instead of a strong acid. As such can acetic acid or still weaker acid as propionic or butyric be used or numerous other organic or inorganic acids of the same strength. It is advantageous if the acid has a tendency to evaporate. By the use of acetates quite 30 easily an improved fixation is obtained and it is easy to solve the corrosion problems. The preservative gives permanent protection and is from environment view excellent. 30

For protection for instance against marine borers, copper compound can be used alone, whilst for ordinary preservative treatment a mixture of the metals can be used, for instance a minor part copper and a larger part zinc. The reason for this is that the zinc will give the preservative a more all round 35 preservative effect. If a colourless preservative is wanted zinc salts are used alone. 35

By different measures the preservatives can be improved. A small amount of a strong acid in form of a sulphate can thus be introduced. This means that the solution of the preservative will be somewhat more acidic and thereby the evaporation of the acetic acid will be hastened/increased. Another measure is to introduce boric acid. Hereby the same effect is obtained to some degree as when a strong acid is 40 introduced. The boric acid is certainly weak but it remains in solution for rather a long time and it does not evaporate. The most essential thing with the introduction of boric acid is, however, to obtain an increased and still more all round effect of the preservative. After some time during the drying of the wood a certain fixation of the boric acid will take place. It is to be considered as an ordinary ingredient in the preservatives. The boric acid meets further another important task. It is an excellent anti-corrosion 45 agent. 45

In the preservative it is further possible to emulsify one or more oils in order to obtain an increased protection against moisture. These oil amounts can be varied considerably. In the solution prepared for wood treatment the oils are present as a rule in a higher amount than in the preservative; they can for instance amount to 5 to 10 eventually 20, per cent of the weight of the solution. The oils to 50 be emulsified can be of different kinds. If a simple water repellent effect is wanted for instance high boiling point paraffin oil eventually containing some amounts of paraffin or wax can be used. If the treatment will be followed by a colouring of the wood the emulsion must have another character. In this case it must not leave "undried" products which can "bleed" through the colour-layer. In these cases drying oils have to be introduced in the emulsion. Such an emulsion can contain paraffin oil or other 55 non-drying oils, such as rape oil, fish oil, and some amount of drying oil, e.g. linseed oil. The amount of linseed oil — or other drying oil — is increased until a good "drying" result is obtained; if necessary the amount of drying oil can be up to 100 per cent. 55

The principles of this invention may seem not to be complicated. There are, however, a lot of fixation aspects of remarkable importance involved in it. It is possible to obtain good fixation results of such a kind that can be easily utilized in practice. The fixation takes place so to say that it corresponds to what is wanted in practice and for getting good results. In order to show these aspects in a simple way a number of leaching tests with copper acetate are presented below. 60

In the tests, 2 and 4 grams of saw dust from the sap wood of pine have been penetrated with 4 ml copper acetate solution of different strengths. The treated saw dust has thereafter been stored in

different ways, and then has been leached. After leaching the remaining amount of copper has been estimated by analysis.

RESULTS OF LEACHING TESTS

	Amount of Cu in solution in per cent	0.3	0.3	0.6	0.6	1.0	1.0	
5	Amount of solution in mls	4	4	4	4	4	4	5
	Amount of saw dust in grams	4	2	4	2	4	2	
Remaining amount of Cu in saw dust after leaching, in per cent								
	Storing, 2 hours without drying	64	45	38.5	29	30	19	
10	Storing, 72 hours without drying	71.5	53	49.5	32	34	19.5	10
	Storing, 72 hours without drying and 264 hours with drying	81.5	63	55	45.5	40	29.5	
	Storing, 72 hours without drying and 1008 hours with drying	84.5	70	64	56.5	48	44	
15	It is astonishing to achieve such a high fixing degrees in such a simple way with a cheap salt. No special solvents or fixing agents are needed. Besides the effect of the metal compound, it is of course the remaining amount of it in the wood that decides the value of the preservation. The zinc in the zinc salts is also fixed in the wood in a similar way as copper but as a rule not to the same degree.							15
20	The fixation seems to take place in about the following way. The copper acetate, which by itself is a stable product, converts in contact with the wood whereby a great amount of the copper radical is firmly fixed. The fixation is thereafter increased by storing without drying and it is still more increased if drying follows. At the same time as the wood dries the fixation thus proceeds. During this process acetic acid is evaporated from the wood successively. It may be pointed out that the unleached copper left in the wood is extremely firmly fixed; it can be considered to be unleachable.							20
25	It seems possible to improve this fixing process further by adding some catalytic active substances to the preservative. Such a substance is, for instance, potassium iodide. The addition of this may as a rule not be done in the solid salt mixture but first in the solution made up for the wood treatment.							25
30	Even if the results obtained in these tests are good they do not show what can be reached in practice. Here the storing time is many times longer and this will increase the degree of fixation. Further the leaching will not as a rule be so severe. The leaching is not so extreme where most treated wood nowadays is used.							30
35	Another still more interesting and positive circumstance — which the leaching tests have had no possibility to cover — is the following. From the tests it is clear that the degree of fixation has a close connection with the amount of preservative introduced per unit weight amount of wood. A small content of preservative is fixed to a higher degree than a higher content. This is a definite advantage over the opposite effect which is the rule for the fixation of negative radicals such as arsenic, fluorine and boron compounds. Surprisingly, the fixed amounts are just over the level needed for obtaining a good protection. In the described tests a certain amount of preservative has been introduced and distributed in a certain amount of saw dust. If the amount of preservative was high, a part of it was							35
40	leachable (remained soluble). When treating wood in practice this part — soluble and leachable in the tests — can diffuse to the inner region of the wood which region have not less (or no) preservative. Here this part has good possibilities to be fixed and here is also more preservative wanted. The distribution obtained by the pressure treatment resulting in decreasing amount towards the inner region of the wood can thus due to the properties of the preservative be improved.							40
45	The corrosion question is no problem when using zinc salts. The different situation arises if copper salts are used. If boric acid is present, the corrosion problem is as a rule under control. In dilute solutions of copper acetate the corrosion is strong, whilst in more concentrated solutions it seems to be inconsiderable. The corrosion can be kept under control quite easily. An addition of 0.01 per cent of sodium nitrite or 0.03 per cent of ammonium acetate to a 1 per cent solution of copper acetate thus							45
50	provides sufficient corrosion protection. Such a protection can also be obtained with other additives. Of interest in this connection is the fact that a small surplus of acetic acid in the copper acetate does not increase the corrosion. A surplus of 0.05 per cent acetic acid has with pure products even showed a certain corrosion protecting effect. If the surplus amount of acetic acid is increased to 0.10 per cent, the corrosion will increase again. With such an acetic acid surplus the corrosion can be avoided by the							50
55	addition of for example 0.01 per cent of sodium nitrite to the solution.							55

In the "full cell" treatment of Swedish pine when as a rule 300 litres of solution are introduced per cubic meter of wood, the following concentrations of the solutions can be used. If a copper salt is used alone, the concentration ought to be around 0.3 per cent copper, whilst for a zinc salt alone the concentration will be around 0.6 to 1.0 per cent zinc. About the same rule can be followed for mixtures 5 of copper and zinc salts. A treating solution of such a mixture can for instance contain 0.12 copper and 0.36—0.6 zinc. These mixtures are as said before often so composed that they contain much more zinc, than copper salt.

Other methods than "full cell" treatment can of course be used for the preservation. The strength of the solution must then be adapted in view of the amount of solution introduced into the wood by the 10 different treatment methods so that the wood receives a correct amount of preservative. As an example 10 the following can be said. When treating wood according to the "Lowry" method the wood receives around half the amount of solution as by the "full cell" method — i.e. 150 instead of 300 litres per m³. In order to introduce the same amount of preservative into the wood a double-strength solution is used with the "Lowry" treatment.

15 15 For diffusion treatment with strong solutions the preservative has special advantages. The preservative diffuses into the wet (green) wood, a certain amount is fixed and the rest further diffuses into the wood where it will be fixed.

The preservative is easy to manufacture, pack and distribute. Other handling is easy because it is a question of a powdered preservative with good environment properties.

20 20 Some examples of preservatives according to the invention are:—

25	1. 98 per cent copper acetate 2 per cent sodium nitrite	
	2. 80 per cent copper acetate 18 per cent boric acid (H_3BO_3) 2 per cent sodium nitrite	25
30	3. 20 per cent copper acetate 60 per cent zinc acetate 18 per cent boric acid 2 per cent sodium nitrite	
	4. 80 per cent zinc acetate 20 per cent boric acid	30
35	5. 85 per cent zinc acetate 15 per cent zinc sulphate	
	6. 100 per cent zinc acetate	
	7. Preservative according to any one of the alternatives 1—6 above, together with an oil-drying and/or non-drying — and an emulsifier.	35

CLAIMS

1. A preservative for wood and other organic materials comprising a copper and/or zinc salt of a weak acid.
- 40 2. A preservative as claimed in claim 1 wherein the weak acid is acetic acid, propionic acid, butyric acid and/or an organic or inorganic acid of comparable strength.
3. A preservative as claimed in claim 1 or claim 2 wherein the preservative contains a minor amount of a metal salt of a stronger acid.
- 45 4. A preservative as claimed in claim 3 wherein the preservative contains zinc sulphate.
5. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains boric acid.
6. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains an emulgated oil.
7. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains an emulgated oil in amount of from 5 to 20 percent of the preserving solution.
- 50 8. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains a soluble nitrite or acetate.
9. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains a soluble nitrite or acetate in an amount not exceeding 0.1 per cent of the preservative solution.
- 55 10. A preservative as claimed in any one of the preceding claims wherein the preservative additionally contains a minor amount of an iodide.
11. A preservative as claimed in claim 1 substantially as hereinbefore described.
12. Wood or other organic materials when treated with a preservative as claimed in any one of the preceding claims.